DOCUMENT RESUME

ED 105 095 CE 003 343

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TITLE A Comparative Study of Microform and Hardcopy as Methods of Presenting Career Information Materials. Research Series No. 44.

INSTITUTION Tennessee State Board for Vocational Education, Nashville.; Tennessee Univ., Knoxville. Occupational Research and Development Coordinating Unit.

PUB DATE Oct 74

NOTE 36p.

EDRS PRICE MF-$0.76 HC-$1.95 PLUS POSTAGE

DESCRIPTORS *Career Education; *Comparative Analysis; *Cost Effectiveness; Educational Strategies; Elementary Education; Evaluation; Grade 6; Instructional Materials; Instructional Media; *Media Research; Media Selection; *Microforms; Program Effectiveness; Rural Areas; Teaching Techniques

IDENTIFIERS Appalachia; East Tennessee; Tennessee

ABSTRACT

The study focused on information that would determine the relative effectiveness and costs of presenting career information to elementary students via strategies utilizing microform and hardcopy. The elementary INFOE (Information Needed for Occupational Education) component was selected for use in the study with the career information presentation being limited to the business and office occupations. Limited to sixth grade students in randomly selected classes in rural Appalachian East Tennessee, the study's experimental design was made up of two experimental groups and one control group, totaling 33 intact sixth grade classes (1,104 subjects, 594 female, 510 male). Means and standard deviations in each of the treatment groups indicated a significant difference in teaching and recall effectiveness favoring microform treatment over hardcopy treatment. Direct costs of using the microform medium of instruction were significantly higher than hardcopy materials, but maintaining the microform program was less costly than maintaining the hardcopy program. Recommendations for further study conclude the document. (MW)

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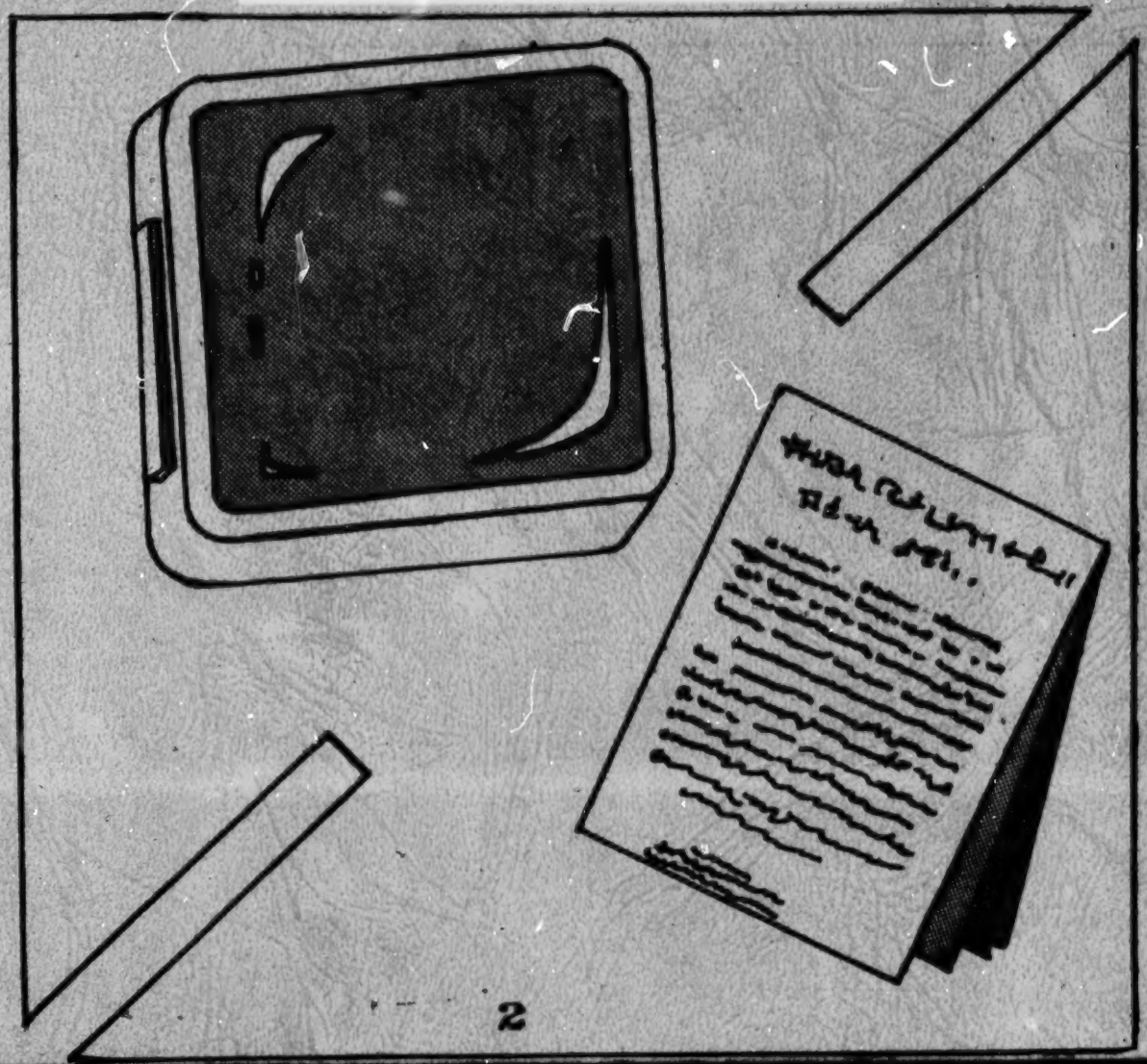

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Research Series
No. 44

A COMPARATIVE STUDY OF MICROFORM AND HARDCOPY AS METHODS OF PRESENTING CAREER INFORMATION MATERIALS

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October, 1974

FOREWORD

The increasing emphasis on career education has resulted in the development of new career education projects and programs. In an attempt to orient students to the world of work, the Tennessee Research Coordinating Unit (RCU) has developed INFOE (Information Needed for Occupational Education), a career information system for students in K-14. Under the direction of Dr. Walter Cameron, INFOE is designed to provide students with basic information on careers as well as information on specific job titles. The INFOE program has been divided into four components: Primary, Elementary, Junior High, and Secondary.

Presented in the following monograph are the findings of a study in which the purpose was to compare the relative effectiveness and costs of teaching career information utilizing the mediums of microform and hardcopy. The Elementary INFOE component (developed for 4th, 5th, and 6th graders) was used in the study, with career presentations being administered to sixth graders in twelve East Tennessee counties in February and March, 1974.

While the monograph is not intended as a detailed account of the Elementary INFOE component, it does present an overview of the study. Tables showing significant facts and figures and a brief glossary of terms are also included. For those desiring more in-depth background information, a thorough bibliography lists relevant and important sources.

It is hoped that the findings, related conclusions, and recommendations of this study will provide pertinent facts for those interested in the effectiveness and costs of presenting career information to elementary students.

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GLOSSARY OF TERMS

The following terms have been defined in order to provide a common basis for understanding the study.

Direct Costs. The direct cost figures apply to amounts related to the purchase of microform and hardcopy hardware and/or software directly used in the classroom.

Hardcopy. Hardcopy instructional materials are presented on paper in printed form (Baldwin and Bailey, 1971).

Hardware. Hardware refers to mechanical devices which magnify and display images found on microform (Veit, 1971).

Elementary INFOE. Elementary INFOE is an acronym meaning Information Needed for Occupational Exploration (Cameron, 1973).

INFOEscript or VIEWscript. An INFOEscript or VIEWscript is a brief description of one specific occupation or job (Hoover and Whitfield, 1968).

Microfiche. Microfiche is a sheet of film containing micro-images arranged in a grid pattern which requires a machine to read (Lewis, 1969).

Microfilm aperture card or aperture card. A microfilm aperture card is a conventional computer card with one or more rectangular openings in which frames of microfilm are mounted.

Microform. Microforms are visual materials containing information that is recorded in a size too small to be identified by the naked eye. Microforms include microfilm,

microfiche, ultrafiche, ultra-reduced microcopy, and photochromatic images (Kottenstette, Morrison, West, and Grausnick, 1971).

Software. Software refers to all instructional materials used in the experiment. Software includes microforms and hardcopy materials.

I. INTRODUCTION

Since the introduction of the career education concept in 1971 by Sidney P. Marland, Jr., there has been an increasing emphasis on the development of career education projects and programs. This emphasis is evidenced in the increased funding by federal, state, and local agencies. Many of the career education projects developed during fiscal years 1971, 1972, and 1973 focused on such objectives as curriculum development and planning, in-service teacher training, and program implementation. With the focus on these objectives, the volume of career education materials was greatly increased. This increase also was due in part to the tailoring of materials to different job requirements in various job locations.

In order for educators to keep abreast of changes and increases in career information materials, questions concerning production, dissemination, and cost of these materials warranted attention. This was particularly true for many small rural schools where adequate financing was not readily available for a full comprehensive educational program that could meet the needs of students at the elementary level (Walker, 1971). Therefore, a number of strategies were developed to produce current, relevant, and relatively inexpensive career information materials, with the two most

common methods of producing and disseminating career information materials being hardcopy and microform (Whitfield and Gleaser, 1968).

As a result of the emphasis on the career education concept, the Tennessee Research Coordinating Unit of the University of Tennessee developed INFOE (Information Needed for Occupational Education), an occupational information system designed to present students in K-14 with basic career information. INFOE, which consists of four components: Primary, Elementary, Junior High and Secondary, was developed with each component geared to the needs of students on that particular level.

Although both microform and printed hardcopy were popular methods of teaching career information, it was not known which would be more effective for presenting this information to students.

II. THE PURPOSE

The purpose of this study was to focus on information that would determine the relative effectiveness and costs of presenting career information to elementary students via strategies utilizing microform and hardcopy. The Elementary INFOE component was selected for use in the study with the career information presentation being limited to the business and office occupations.

Studies by Baldwin, Bailey, Kottenstette, and Gaddy indicated a need for: 1) research in the comparison of microform and hardcopy presentation, 2) research which focused on the design of the specific instructional materials using the medium of microform, and 3) an extensive exploration of the capabilities of microforms as a means of disseminating information.

Further review of the literature revealed that no definitive research had been completed on the recall of career information as presented via the medium of microform or the medium of hardcopy. Therefore, this study appears to be the first to compare the mediums of microform and hardcopy in presenting career information materials to elementary students.

III. OBJECTIVES OF THE STUDY

Based upon the purpose of the study, two specific objectives were identified. The primary objective of the study was to determine whether randomly selected classes of sixth grade students from rural schools in East Tennessee recall career information on business and office occupations as well from microform as they do from printed hardcopy. The secondary objective was to determine the relative direct costs of implementing an Elementary INFOE system in rural schools in East Tennessee via the media of microform and the media of hardcopy.

To fulfill the objectives of the study, answers to the following questions were sought:

1. Would the recall of career information by sixth grade students be greater for students receiving a career information presentation on the business and office careers via the medium of microform or the medium of hardcopy as compared to students receiving no career information presentation?

2. Which of these two media, microform or hardcopy, was more effective when used to present career information of the business and office career cluster to rural sixth grade students?

3. What were the relative direct costs of presenting an Elementary INFOE program using the mediums of microform and hardcopy in rural schools?

IV. SCOPE AND LIMITATIONS OF THE STUDY

The following factors limited the scope of the study:

1. The study was limited to the sixteen counties of the East Tennessee Development District and the eight counties of the First Tennessee Development District in the State of Tennessee.

2. Only students in the sixth grade classes were studied.

3. Career information material was limited to job titles in the business and office career cluster which is part of the Elementary INFOE Career Information System (Cameron, 1973).

V. PROCEDURES

Selection of Career Information Material

The selection of the Elementary INFOE system of career information for use in the study was based upon the following criteria: 1) material should be compatible with presentations in microform and hardcopy, 2) the content should be relevant to career information, 3) materials should be easily understood by elementary students, 4) information should be of interest to both male and female students, and 5) instructional material should be inexpensive to reproduce. Those criteria were used to assure continuity of material, student interest, and economy in replication of career information materials.

The content of the Elementary INFOE material was used because: 1) the material was developed around interests and abilities of sixth grade students, 2) materials were inexpensive to duplicate in quantity, 3) materials were designed for both individual student or group instruction, and 4) materials were localized to the Southeastern region of the United States.

Due to the volume of material in the total Elementary INFOE system, the time required to cover all career clusters would have been quite extensive. Therefore, only one cluster was selected for observation. The cluster of business and office careers was selected because the content was easily understood by elementary students and was related to jobs

available to both males and females. Also, training for most of the jobs in the cluster was available in public school systems.

Development of Lesson Plans

In order to maintain a consistency in the presentation of the Elementary INFOE career information material, lesson plans were developed for each of the three treatments of the study: microform, hardcopy, and no presentation. Each lesson plan was developed on a format based upon applied teaching techniques as outlined by Weaver and Cenci (1960).

Evaluation Instrument

A sample test instrument was developed and submitted to a panel of experts for review and criticism. Suggestions from the panel were reviewed and incorporated into a revised test instrument. The revised test instrument was submitted to five practicing sixth grade teachers for review and criticism on readability of the test instrument.

Selection of Microform Readers

Due to the lack of availability of microform readers in the elementary schools participating in the study, it was necessary to supply sufficient numbers of readers for use by the classes receiving microform presentations.

Therefore, the microform readers selected were easily portable yet sturdy enough for use by students not accustomed

to handling and operating microform readers. Through the process of personal interviews with personnel at the Tennessee Research Coordinating Unit who were involved with the dissemination of microform materials, along with a review of related literature on microform applications, the following criteria were established for the selection of a microform reader for use in the study:

1. The microform reader had to be light weight and of a compact size affording ease of portability.

2. Sixth grade students must be able to operate the microform reader easily.

3. The microform reader must be adaptable for acceptance of the aperture card format of microform.

Based on the established criteria for selecting a microform for use in the study, the Bell & Howell Briefcase Reader was the model selected. Twenty (20) Briefcase Readers were made available on a loan basis for use in the study.

Pilot Study

During the months of January and February, 1974, a study was conducted in five classes of sixth grade students for the purpose of determining the reliability of the test instrument. Hardcopy materials were used in the presentations of the pilot study.

An item analysis of test data was used to determine the internal consistency of the test on how effectively each

test item measured whatever the total test was measuring. The Kuder-Richardson Formula 20 was applied to test data to obtain a reliability coefficient of internal consistency for the complete test. The computation of the KR-20 resulted in a reliability coefficient of .72 which was of an acceptable level (Downie and Heath, 1970). As a check on the KR-20 formula, the Kuder-Richardson 21 formula revealed a reliability coefficient of .716, thus confirming the calculations of the KR-20 formula.

The item analysis of test data from the pilot study revealed that the items of the test instrument were of high discriminating power and the difficulty index was of an acceptable level. Based on the acceptable discriminating power, difficulty index, and reliability coefficient level, the test instrument used in the pilot study was used intact in the actual study.

Finally, the pilot study determined the time required to complete the instructional and testing presentations as outlined in the hardcopy lesson plan. Total time required for presentation and testing varied from 1 hour 55 minutes to 2 hours 10 minutes. The variance resulted from students returning to class late from the breaks in the presentation.

VI. THE STUDY

The experimental design used in the study was classified as the Posttest-Only Control Group Design (Campbell and Stanley, 1967), with two experimental groups and one control group. This design appeared most appropriate for the experiment because the likelihood of reactive responses from exposure to a pretest did not exist. The two experimental groups and one control group were made up of 33 intact sixth grade classes located in the First Tennessee Development District and the East Tennessee Development District. The 33 intact sixth grade classes were randomly selected from a total of 454 sixth grade classes. In all, 1,104 sixth grade students in 12 different counties participated in the study. Of the 1,104 subjects, 594 were female and 510 were male. The number of male and female subjects in the study are presented in Table I.

TABLE I

NUMBER OF MALE AND FEMALE SUBJECTS IN EACH TREATMENT GROUP

Treatment Group	Male Subjects	Female Subjects	Subjects in Treatment Group
Microform	176	229	405
Hardcopy	178	186	364
No Presentation	156	179	335
Total	510	594	1,104

The two experimental groups each had 11 randomly selected classes. In the first group each class received a career presentation via the media of microform and in the second group each class received a presentation via the media of hardcopy. The third group which was the control group also consisted of 11 randomly selected classes. Each class in this group received no presentation of career information. All groups (experimental and control) were tested for recall of information on the career information material. The career information presentations and testing were completed during the months of February and March, 1974.

The total time required for the study was sixteen working days which included two presentations per day with one day having only one presentation. The presentations were given as soon after the beginning of classes in the morning or as soon after lunch period as practicable.

All answer sheets were scored by a mark sensing reader at the Tennessee State Testing and Evaluation Center, Knoxville, Tennessee. The test data were then subjected to the Statistical Analysis System (SAS) computer program which applied a randomized block analysis of variance (ANOVA) with a least squares regression procedure.

VII. SUMMARY OF FINDINGS

The findings of this study were based on the two specific objectives which were identified for investigation. The primary objective was to determine whether randomly selected classes of sixth grade students from rural schools of East Tennessee could recall career information on business and office occupations as well from microform as they do from printed hardcopy. The secondary objective of the study was to determine the relative costs of presenting a complete Elementary INFOE system in rural schools of the Appalachia Area in East Tennessee via the media of microform and hardcopy.

Recall of Career Information

Since the number of subjects differed within each of the 33 classes which made up the three treatment groups, it necessitated the application of the SAS computer program and the randomized block ANOVA for unequal subclasses.

Among experimental and control groups used in the study, there were recognized differences in the mean scores among the treatment presentations of microform, hardcopy, and no presentation. Mean scores and standard deviations of the treatment groups are shown in Table II.

TABLE II

MEANS AND STANDARD DEVIATIONS
IN EACH OF THE TREATMENT GROUPS

Treatment	Mean	Standard Deviation
Microform	14.48	1.11
Hardcopy	11.88	1.10
No treatment	7.81	.81

These figures indicated that: 1) the experimental groups of microform and hardcopy differed significantly from the scores of the group receiving no presentation; 2) the means of the hardcopy treatment (11.88) and the no treatment group (7.81) show a significant difference in favor of the microform treatment; 3) the means of the microform treatment (14.48) and the hardcopy treatment (11.88) showed a significant difference in favor of the microform treatment.

Effectiveness of Microform and Hardcopy

In answer to the question of which mediz, microform or hardcopy, was more effective in presenting career information to rural sixth grade students, the figures revealed that the microform treatment scores differed from the hardcopy treatment scores. This supported the effectiveness of the microform treatment over hardcopy treatment.

Relative Costs of Presenting Elementary INFOE

In order to fulfill the secondary objective of determining the relative costs of presenting an Elementary INFOE system in rural schools of the Appalachia Area of East Tennessee, it was necessary to ascertain: 1) the cost of presentation using the medium of microform and 2) the cost of presentation using the medium of hardcopy.

In determining the relative costs, the following limitations were made:

1. All cost figures were obtained from the Research Coordinating Unit for Vocational Education.

2. Purchase price on major pieces of equipment was not considered in cost of presenting the Elementary INFOE program. Major pieces of equipment were defined as; (a) printing press; (b) plate maker; (c) microform process camera; (d) microform duplication machine; and (3) keypunch machine.

3. All cost figures represented a complete set of Elementary INFOE materials which include 15 career clusters.

4. All cost figures were based on an average class size of 30 students.

5. All cost figures were based on the assumption that one set of Elementary INFOE materials was needed for every two students.

6. Projection of cost figures was based upon two year replacement of software and six year replacement of hardware.

The total cost of materials and equipment to initiate an Elementary INFOE career information system in rural schools in East Tennessee was $1,485.75 for the microform medium whereas the hardcopy medium was $172.65. The greater cost of the microform medium was due to the cost of purchasing the microform readers. By amortizing the cost of microform readers over a six year period, the yearly cost per reader would be $15.50. A breakdown of first year cost for Elementary INFOE via the mediums of microform and hardcopy is given in Tables III and IV.

TABLE III

FIRST YEAR COST[1] OF PROVIDING 15 CAREER CLUSTERS OF ELEMENTARY INFOE MATERIALS VIA THE MEDIUM OF MICROFORM TO A CLASS OF 30 STUDENTS

Microform readers--unit cost	$ 93.05
Number required (2 students per reader)	15
Total cost of microform readers (15 x $93.05)	$ 1,395.75
Processing of aperture cards per unit	.02
Number in each deck	300
Cost per deck of software (.02 x 300)	$ 6.00
Elementary INFOE software decks required	15
Cost of 15 software decks	$ 90.00
Total cost of initiating an Elementary INFOE microform system ($90 + $1,395.75)	$ 1,485.75

[1]Cost figures obtained from Research Coordinating Unit, Knoxville, 1974.

TABLE IV

FIRST YEAR COST[1] OF PROVIDING 15 CAREER CLUSTERS OF ELEMENTARY INFOE MATERIALS VIA THE MEDIUM OF HARDCOPY TO A CLASS OF 30 STUDENTS

Total number of pages (76 pages per cluster x 15 clusters)	1,140
Printing cost per page	.01
Printing cost per unit	$11.40
Cost of Binding per unit	.11
Total cost of printing and binding INFOE software ($11.40 + .11)	$11.51
Elementary INFOE software booklets required (2 students per booklet)	15
Total cost of initiating an Elementary INFOE hardcopy system ($11.51 x 30)	$172.65

[1]Cost figures obtained from Research Coordinating Unit, Knoxville, 1974.

Over a six year period, career information would have changed enough to warrant two complete changes of career information instructional software. The cost of microform software for the six years would be $270.00, whereas the cost of hardcopy software would be $517.95. The comparison of costs for career information software revealed microform software to be less than hardcopy software by $247.95.

Based on minimum figures, the total cost of presenting the microform medium for six years would be $1,665.75, whereas the cost of presenting the medium of hardcopy would be $517.95. On a yearly basis, the cost would be $277.62 for microform and $86.32 for hardcopy. The greater cost of $191.30 for microform could easily be offset by the use of microform readers as an instructional tool for educational presentations other than career information. Relative costs of presenting Elementary INFOE are illustrated in Table V.

TABLE V

RELATIVE COSTS OF PRESENTING ELEMENTARY INFOE VIA MICROFORM AND HARDCOPY

	MICROFORM MEDIUM	HARDCOPY MEDIUM
Total cost to initiate an Elementary INFOE career information system	$1,485.75	$172.65
Total cost of presenting an Elementary INFOE system for six years	1,665.75	517.95
Yearly cost of presenting an Elementary INFOE system over a six year period	277.62	86.32
Yearly cost for replacement of Elementary INFOE software on a two year basis	45.00	86.32

VIII. CONCLUSIONS

In fulfilling the specific objectives of this study, the following conclusions were drawn:

1. There was a significant difference in the amount of career information recalled by rural sixth grade students of East Tennessee receiving a career information presentation via an instructional process of microform as compared to students receiving no career information instruction.

2. There was a significant difference in the amount of career information recalled by rural sixth grade students of East Tennessee receiving a career information presentation via an instructional process of hardcopy as compared to students receiving no career instruction.

3. There was a significant difference in the amount of career information recalled by rural sixth grade students of East Tennessee receiving a career information presentation via an instructional process of microform as compared to the instructional process of hardcopy.

4. There was a difference in the direct costs of presenting an Elementary INFOE system using the medium of microform and the medium of hardcopy. In a comparison of direct cost figures for the initiation of a complete Elementary INFOE system, the hardcopy medium cost less than the microform medium. However, the direct cost figures for replacement and maintenance of Elementary INFOE software indicated the

medium of microform to be less expensive than the medium of hardcopy.

Related Conclusions

1. Sixth grade students in rural areas of East Tennessee, receiving career information presentations via the media of microform answered more questions correctly on a test of career information than did students receiving no presentation.

2. Sixth grade students in rural areas of East Tennessee, receiving career information presentations via the media of hardcopy answered more questions correctly on a test of career information than did students receiving no presentation.

3. Sixth grade students in rural areas of East Tennessee, receiving career information via the medium of microform answered more questions correctly on a test of career information than did students receiving career information via the medium of hardcopy.

4. The cost of establishing an Elementary INFOE career project is greater for the media of microform than it is for the media of hardcopy. However, the cost of maintaining an Elementary INFOE program with up-dated materials is greater for the media of hardcopy.

IX. FINAL STATEMENT AND RECOMMENDATIONS

The present study revealed the medium of microform to be a viable method for delivery of career information material. Even though the study was limited to the presentation of career information to elementary students, the use of microform could be extended for use in many other instructional areas. With increasing costs of administering instructional programs, the use of microform applications should become more appealing to budget minded educational administrators. As the medium of microform is used more, its usage could equal the other methods of delivery such as hardcopy, television, or motion pictures. General acceptance of microform applications would yield a realized saving in material cost, replacement cost, and storage space.

The findings of this study have pointed out the need for additional study. The following recommendations were set forth:

1. The methodology and procedures of the present study should be replicated in the same population with presentation of another career cluster. This would afford a comparison of research and statistical design.

2. The methodology and procedures of the present study should be replicated in the same population presenting the same career information materials, with a change in the objective of recall of career information material to retent[illegible]n

of career information material over an extended period of time.

3. The present study should be completely replicated in urban school settings. This would afford a complete comparison with a different user population.

4. The methodology and procedures should be used in conjunction with career information materials specifically developed for secondary students.

5. Further research is needed in the determination of cost effectiveness of microform applications in other educational instructional areas. In order to justify the implementation of microform programs in instructional areas, educational administrators must first be concerned with the merits of cost effectiveness.

6. State educational agencies should consider implementing career information systems in elementary, secondary, and post-secondary schools within their states, utilizing the microform medium as the delivery system.

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